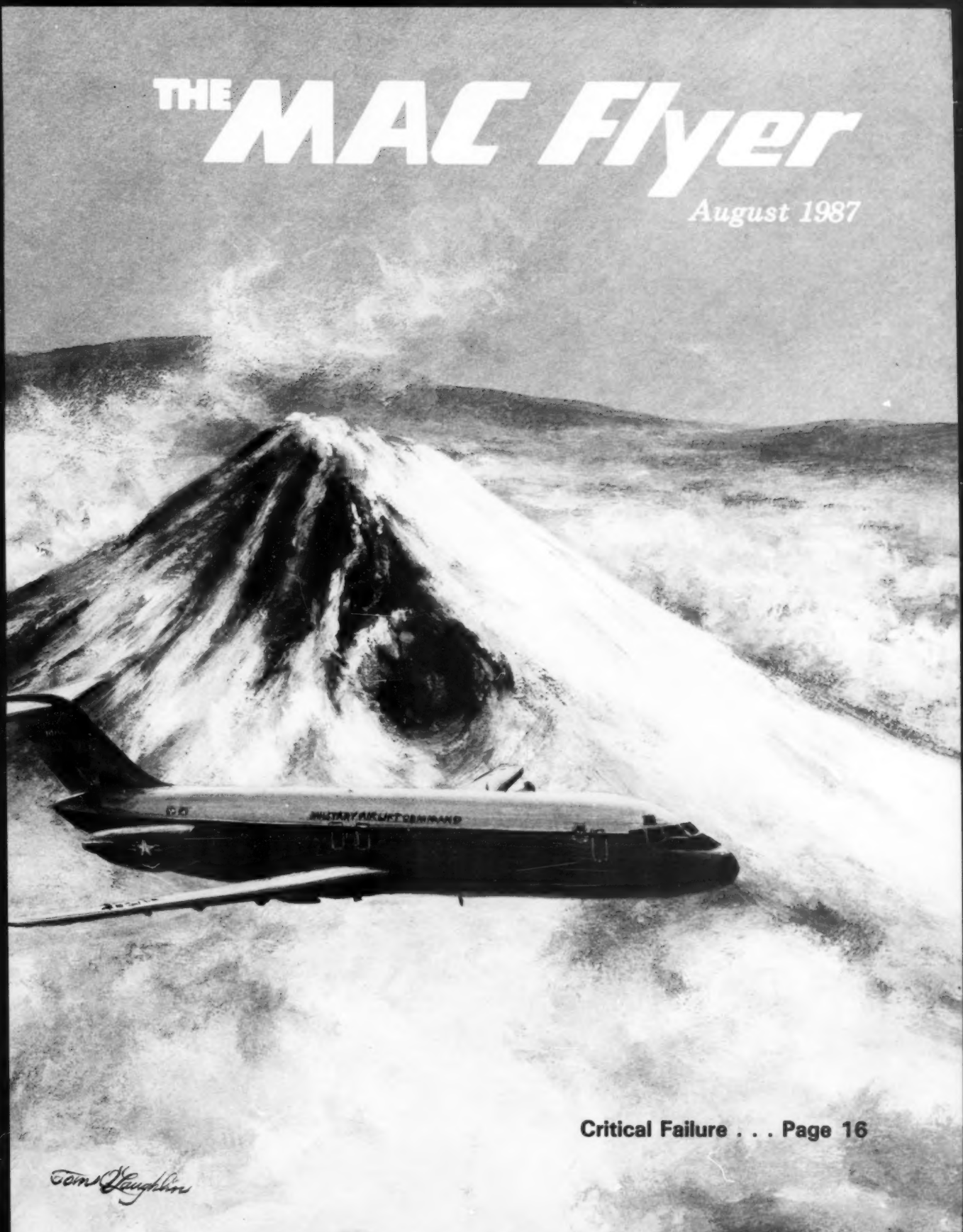
THE MAC Flyer

August 1987



Critical Failure . . . Page 16

Tom Laughlin

THE MAC Flyer

For Greater Safety in MAC Air Operations

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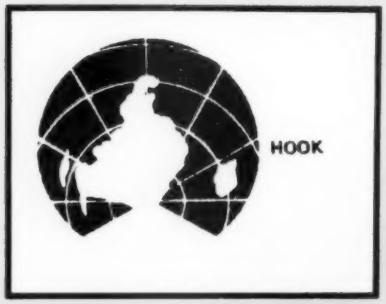

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The creeper had made his entrance . . .

The "Creeper" is with You

Capt. Keith A. Michel
1550 TCHTS, Kirtland AFB, New Mexico

During my Air Force flying career, I've met many people and experienced a lot of things, but the times I came face-to-face with the "creeper" are meetings I wish I could have avoided.

The creeper is a situation, but also a little like a person. He enjoys human company immensely. He's on every flight he can catch, just waiting for the chance to introduce himself. When he does, watch out. An association with him is like hanging around the bad kid on the block; you're just asking for trouble. I've had two encounters with the creeper and I guess I'm the better for it—but only because I escaped his disastrous icy grip. Maybe if I tell you about my experiences with this notable adversary, you'll avoid him the day he tries to make a mishap statistic out of you.

My first experience with the creeper occurred when I was a crisp, freshly-pressed new aircraft commander at my first assignment. At this unit, where we flew the H-1 helicopter, it wasn't unusual for very young and relatively inexperienced pilots to upgrade

Second Place 1987 MAC Flight Safety Writing Contest Winner

quickly to AC. It seemed if you just hung around the unit long enough to learn the basics of the mission and aircraft, you were bound to eventually upgrade. It was a little like waiting for rain; if you stood in one spot long enough it was going to come down sooner or later.

Despite this tendency to upgrade quickly, I felt both lucky and proud when I became an aircraft commander. It was a position of responsibility, requiring sound judgment and an ever-open eye on the big picture. I was the guy who had to know the right and safe thing to do—always. It was a challenge I relished and a job I looked forward to performing.

On the day I first met my nemesis, our mission was simple and straight-forward. (Doesn't every bad flight seem to start that way?) Our job was to fly to as many missile sites as practical, pick up passenger manifests located in the mailbox next to the helipad, and bring them back to base. This mission was like money in the bank; Keith, my copilot, would personally take care of everything. Puffed with pride over my latest (and only) successful upgrade, I nonchalantly approached the mission as just another trip around the pattern, and didn't sit down to properly consider the things that can go wrong on *any* flight, regardless of the mission.

Everything progressed easily enough as we hit six, seven, then eight missile sites. There was a lot of chit-chat about what we were going to do that weekend and how things were in general for each of us, and somewhere along the line I lost that crystalline-pure concentration you need on every flight. I was there, but not as much as I should have been. *The creeper had made his entrance.*

I was keeping an eye on the fuel gauge and at every site I made a quick "educated guess" on what we would need to get back to base. According to regulations, we had to land with no less than 200 pounds of fuel. This was a *minimum* requirement, and considering recent problems with undependable fuel gauges in the H-1, dipping beneath 200 pounds was considered detrimental to one's longevity. Fuel management was important. I gave what I thought was careful consideration to all relevant factors; however, I quickly discovered my consideration was neither careful nor well thought-out, but rather casual and vague.

We had flown about one hour and 40 minutes when we took off from our eighth site. Fuel was getting a little low. We had about 475 pounds indicated, which meant we had a max of 275 pounds or about 28 minutes (burn rate of 600 lbs/hr) of flight time. It was ten miles to base. If we returned now we would land with about 375 pounds and not even 2 hours of flight under our belt. Two hours was considered minimum for a standard sortie, so I certainly didn't want to track in with a meager 1.9. It was time to prove my mettle and show everyone how I could aggressively pursue completion of the mission. I'd get the job done better than it had ever been done before.

We were six miles from the nearest site. If we "beat feet" there, spent minimum time on the ground, and rushed back to base, I figured we could land easily with at least 225 pounds and a large fistful of manifests to proudly wave under the ops officer's nose. So, with an air of confidence, I turned toward our ninth missile site and an *encounter with the creeper.*

We reached the site even quicker than anticipated. As the copilot jumped out to grab the manifests, I rolled the throttle to flight idle to save gas. This was going to be easy. Unfortunately, I didn't notice the mailbox was over 200 yards away from the pad, and the copilot had to slowly make his way around and through a perimeter fence surrounding the complex. It was a solid ten

minutes before he came back.

As I rotated the throttle to full open upon his return, I felt a sinking feeling in the pit of my stomach as I saw indicated fuel had already dipped to less than 300 pounds. What was going on? It wasn't till later I learned the fuel gauge in the H-1 didn't always decrease at a constant rate. It often "hung up" at about 500 pounds then *quickly* decreased from there. It turned out the 475 pounds I thought I had was actually a whole lot less, and I just happened to be sitting on the edge of the drop-off.

We took off and began a hurried flight back home, only to discover that my ignorance had led to another blunder: A headwind I hadn't considered. We were flying all the way back to base in a 30-35 knot headwind. In a helicopter that really slows you down. I went as fast as I could and watched helplessly as indicated fuel dipped dangerously below 200 pounds. I was still five miles out. *Should I land?* No! My stupid pride just couldn't accept this alternative. I kept on.

I continued my now illegal flight, and finished an uneventful approach, landing, and shut-down. The gauge showed about 100 pounds of gas, less than half the minimum. I cursed my stupidity. How could I have let this happen? My ignorance obviously was more real than I ever considered possible. There were at least a half dozen things I had not considered for safe completion of my flight. Individually, they were all small, but collectively added up to one enormously bad situation—a potential flame-out.

Poor preflight preparations; incompetent fuel management; failure to consider effects of a headwind . . . I had carelessly allowed a series of factors to "creep" into my mission, combine forces, and try to hurt me. They had quietly slipped into different phases of my flight, and I simply allowed them to continue creeping in until they threatened the very safety of the mission itself. My first encounter with the creeper had resulted in a bona-fide debacle, but I had been lucky. Although I still didn't grasp the full significance of my first encounter, I learned a valuable lesson about performing any mission in a half-cocked, unprofessional manner. The best lessons are paid for with your own sweat and blood. I had paid dearly so far, but I wasn't finished paying yet . . . .

Final payment came due several months later during a navigation training ride. The flight was going to be an enjoyable break from more monotonous duties, so both the copilot and I eagerly looked forward to this opportunity to break out of the local pattern and head for the great unknown. It turned out to be a little too unknown for my own good.

The weather was marginal the previous day, but on the morning of our flight the sun was shining, the winds were light, and it looked like the best day imaginable for flying. The weather briefing for our flight area was a little less cheerful, though. Scattered rainshowers and thunderstorms were forecast throughout the day, and although no stations reported any significant weather conditions at the time, it appeared we might have less than perfect flying weather ahead of us.

However, destination weather was forecast to be 4,500 broken, and we really wanted to go, so we decided the weather wasn't anything worth cancelling the flight over. We rarely flew at altitudes above 1,000 ft AGL, so a 4,500-foot ceiling seemed to be a carte blanche invitation for flight. It was the call of the siren. My first mistake was believing a destination forecast reflected weather we would find *enroute* to destination, an area of rugged terrain, large ridge lines and valleys, and many peaks well over 9,000 ft high.

The creeper had his foot in the cabin door.

We departed the local flying area and entered the mountainous region to the south. It was a beautiful area, and we were having a wonderful sightseeing excursion—at least until we noticed what looked like fog in the valley we were about to enter. I'd seen several patches of low-lying scud the past 5-10 miles and hadn't thought too much of it; but this was a bit different. As we approached the valley and the sun slowly began to disappear behind a veneer of clouds, I realized we would never be able to continue our present route of flight. The valley was socked in. Then, as I pondered the options, it began to rain. The outside air temperature was near freezing.

As the first raindrops began to fall, I regretfully remembered I had checked neither anti-ice or pitot heat prior to takeoff. That had been a real blunder. It didn't take much ice build-up on the blades of an H-1 to end your flying day altogether. I turned on the anti-ice and pitot heat and breathed an uneasy sigh of relief when I saw they both worked. What else had I missed?

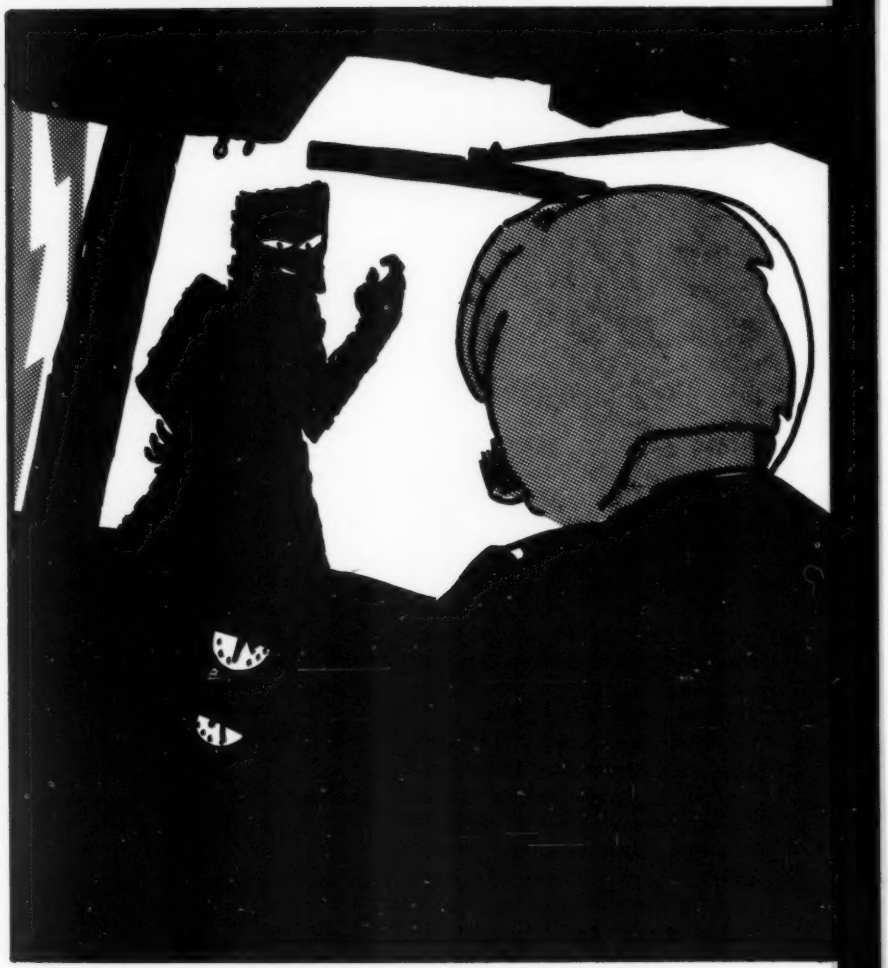
"We can follow this river valley to our left down to the lake," my copilot said, "and that'll keep us away from mountains and bad weather in front of us. From there we can see what navaids we can pick up to help us determine an alternate route to our destination."

We turned down the river valley. I peered toward the clouds and fog which ominously obscured

most of the valley and mountains to my right. *Nasty stuff.* I much preferred being here than there.

The copilot turned on the windshield wipers and I heard swearing from the other side of the cockpit. "My windshield wiper doesn't work! There must be a short somewhere!" As if visibility wasn't already becoming an increasing concern, his was being reduced even more. The rain was still fairly light, and his visibility wasn't reduced too much, but I found myself relying more and more on what I alone could detect in front of the airplane. I had effectively lost my scanner on the opposite side.

As we drew within a couple of miles of the lake, we started dodging pockets of heavy rain and snow showers standing out like small scraps of white curtain against the landscape. I found I usually had to dodge everything to my side of the airplane (the right), since my copilot still couldn't clear me to turn his way. This brought me a little closer to the mountains, now completely covered by sheets of falling rain and snow. I have to keep out of there, for sure. I wonder how high those mountains really are . . . I can see so little of them . . . .



We slipped past the lake. It had a large, thick layer of fog hanging over it, and on the opposite side was a large peak draped with clouds. Now we had high obstacles on both sides of our route. The only way to go was straight down the valley and do the best we could to avoid rain and snow showers.

We flew into an area where the valley opened up a bit and the visibility improved slightly. But as I looked ahead I saw a wall of clouds lurking ahead. The rain began to beat with a new energy, and I guided the aircraft into whatever clear space I could find. It was now no longer a matter of avoiding rain and snow, but finding the area where it appeared lightest. We flew a heading of 150 degrees, then right to 190 degrees for a minute, then further to 220 degrees.

"I'm not really sure where we are," said the copilot, "but I think we're awfully close to a restricted area."

GREAT!!!

"What's the highest peak in this area? Look at the sectional—what's the max elevation in our block? Do we know which block we're in?"

"Uh, it's 7,900 feet. But we're real close to the next block and there it's 10,000! I'm pretty sure we're not in that area, though."

That didn't do much to settle my nerves. We were flying at about 6,800 ft as we skirted through and around the weak spots in the weather. This is a fine mess . . . If I go IMC I'm climbing to 11,400. I just can't take the chance. I had hurriedly yanked out an approach plate a few miles back. There was an airport near the lake we'd passed. It had one approach—a *circling* VOR. The minimum sector altitude to the north of the VOR was 11,400 ft

and to the south 8,600, but I didn't know how far away I was from the station or what I would fly over to get there. Worse yet, the navaid identified was weak and certainly not dependable because of our low altitude in the mountains.

You can't land here, there's nowhere to put the aircraft down safely. Okay, okay . . . if you punch in you'll have to go to 11,400 and do your best to get back to the VOR. VMC is getting to be a real chore. Stay calm—keep your wits about you.

We couldn't go ahead. I had to turn.

"I have us on the map, I think," came the anxious voice from the other seat. "If you can turn to 330 degrees we'll get back to the airport."

I began a gradual turn to 330 degrees. It was clear so far, but as I rolled out we both choked in surprise as we saw a new series of rain and snow showers sneaking in behind us trying to cut off our retreat. There was one area that looked a little thin. I kept my altitude and headed toward it. If I climbed more than a couple hundred feet I'd be right in the thick of it.

"Get a good ident on that navaid," I instructed the copilot, "and tell me about anything, repeat, anything you see out there!"

"I've got the VOR! We're heading almost right at it!" he said hopefully.

This was the moment of truth. We approached the wall. If this doesn't work, climb to 11,400 and go for the VOR! Keep it simple. Remember TIMS: Tune—Identify—Monitor—Select. I looked again at the approach plate. Not really a good review of the approach. I could really use 30 free seconds. We were there. Stay calm. You know the options now. They're limited but pretty clear cut. As we slowly entered the weak part of the wall, I was able to peer just ahead and faintly make out terrain features on the other side. Then more, in even better detail: We had broken through. Ahead, not four miles away, was the airport. We landed and shut down the aircraft.

I've had a long time to think about these experiences, and I believe I've come to some pretty firm conclusions. First, there certainly was a pattern of carelessness and poor preparation. Second, I ignored the accumulation of many small developments, each rather innocent individually, but collectively snowballing into one very big problem. Third, and most important, I was the one person who could have done something to avoid all this, and twice had done nothing. I, alone, let all those factors creep into my flight and try to kill me. Or allow me to kill myself. *The creeper had nearly sucked me in twice.*

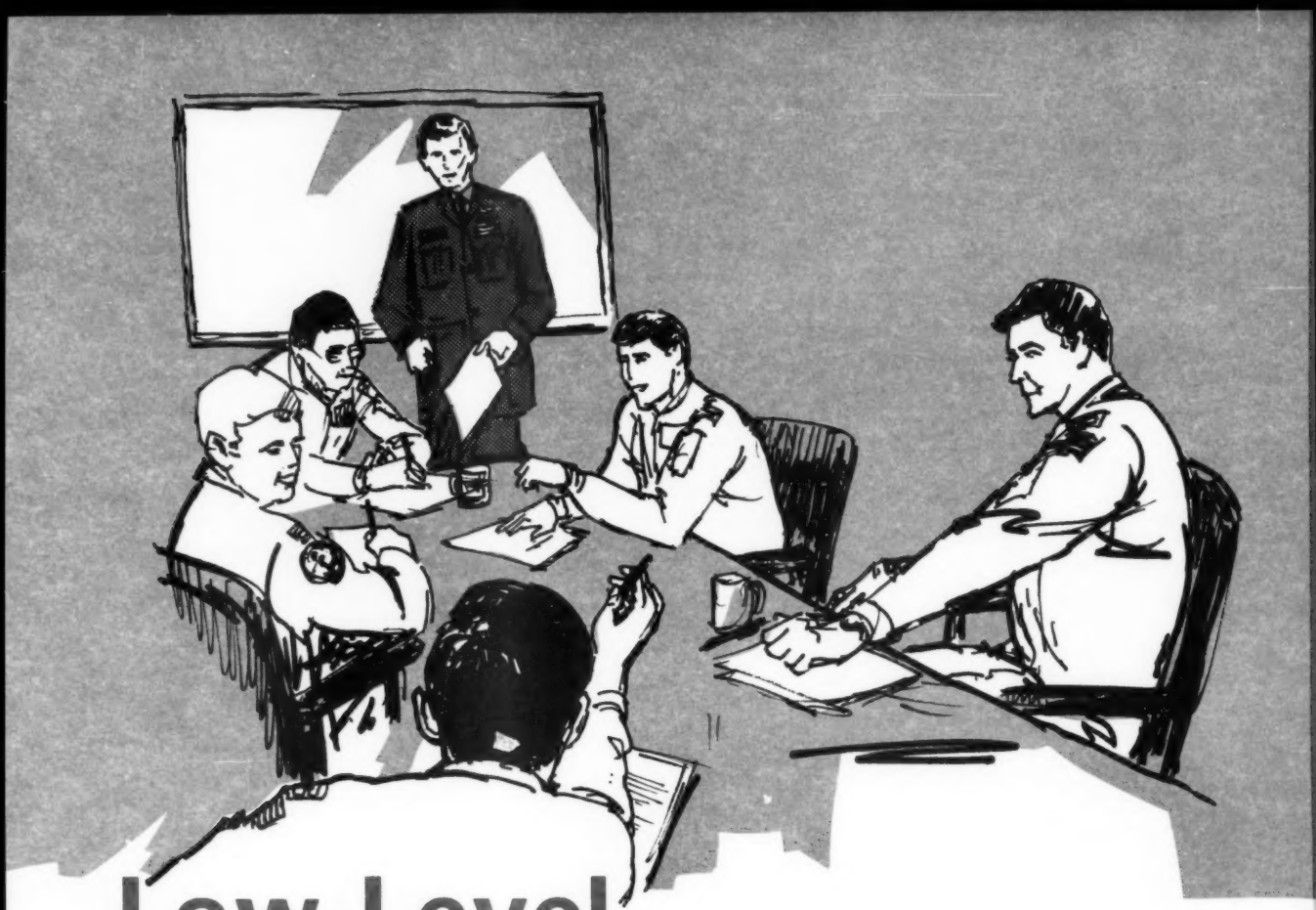
Not checking anti-ice or pitot heat; the consequences of an inoperative windshield wiper; flying into marginal weather without a plan in case I went IMC . . . . It was a litany of errors in judgment and safety. We had deviated significantly from our filed course. What if we had crashed? What if one of my crewmembers had needed immediate medical attention? God knows how long it would have taken someone to find us.

If a wing falls off a plane, there's really not much anyone can do. You somehow get the idea the crew's fate had been irrevocably sealed by a higher authority than our own. But what about all those other accidents having so many contributing factors, such as lack of supervision, self-medication, or violation of directives, to name a few? I finally saw the creeper had done to them what he tried to do to me, mainly, coax me into his web of deceit and false security and finish me off. I concluded with a sobering thought: We're only human, and our ambitions too often reach past the abilities of our frail bodies.

The creeper is made up of your worst nightmares and greatest fears, but if you ever listen to his voice he'll sound like the best and most trusting friend you've ever had. *"Go ahead. It's okay. What's one more little thing?"*

Something can go wrong on any flight. A little thing now, coupled with a few other little odds and ends later on, might just be the perfect recipe for disaster on your flight. It's the creeper's modus operandi to start small and grow. I escaped him, not once but twice, and he'll never be on my plane again. But I know he's out there every day, looking for the next available flight and asking crewmembers, *"GOING MY WAY?"* ★

Capt. Keith A. Michel is a 1980 Southwest Missouri State University graduate. After graduating from UPT-H at Ft Rucker, Alabama in 1982, Captain Michel flew the HH-1H for three years at McConnell AFB, Kansas. Currently an instructor at Kirtland, Captain Michel is a recent selectee for fixed-wing conversion.



Low-Level Lightning

"Thank you, Lieutenant McBride. Gentlemen, that concludes the formal portion of the briefing. There will be a specialist's briefing for the navigators in the tactics room. We've arranged for a bus out front in 15 minutes."

Lt. Arthur Myernieder's tactical briefing had gone pretty well. He'd had the usual jitters, tripped over words here and there, and it *was* kind of mechanical, but it had been a good effort and a good briefing. He was going to do just fine, Brad thought. This ought to be a pleasant flight. It's a rare event for me to fly as an actual instructor to an eager AC upgrade student like Art. His Form 21 reads like an instructor's fantasy; he literally flew through lead upgrade, and so far, his planning abilities have borne out the glowing thoughts of other instructors. I guess I'll just have to ride along and hope I know the answers to the trivia questions he's bound to come up with. I've noticed that all new pilots are asking questions all the time. It's tough to remember these guys *are* serious, and every question is worth the effort to answer.

"Hey, you coming along or what?" Art asked sarcastically.

"Yeah, sure, Art. Coming right now. I guess I was just daydreaming a little. These humid afternoons really get to me. I'll bet it's still over 90 out there."

"So the weather guy said. Gee, Mac, you really aren't too 'with it' this evening. When we get

back in, you better grab yourself some health food and start psyching up; this is going to be quite an evening. We've got a live heavy drop, followed by two real personnel drops. I don't think I've seen more than one actual load per aircraft in the three years I've been here."

"Well Art, we've got to start now if we're going to field a crew for Airlift Rodeo and win. The competition never gets any easier; did you see the German team?"

"Let's worry about that next year, Mac. Tonight we're leading a six-ship. If we can get the first three drops off before the weather closes us down, it'll be a successful night. We can always drop the sandbags another night, but I'd hate to see the actuals wasted."

"Yeah, I'm sure the troops echo that sentiment. I'll just bet the thought of droning around the skies dodging thunderstorms excites them even less than us. I hope the radar works."

"Oh well, the sooner we're airborne the better, as far as I'm concerned. Here's the bus. Grab your helmet and let's go."

"Right with you, and here comes our famous navigator. Well Jack, how'd the specialist briefing go? I'm always thrilled to know I've got someone 'special' on board for these tactical routes."

"Hey, it was a real thrill, Mac. They discovered I chummed my chart wrong, and I found an error in the 512 which places the CARP on the other side of the zone. It seemed a bit odd, right drift with a run-in 125 yards right of the PI. So I guess these so-called specialist briefings are worthwhile after all."

That's Jack, Brad thought; he'd find something positive to say about sitting in superglue. "What about this weather, Jack. It looks a bit iffy, don't you think?"

"It'll give us something to think about between perfectly executed airdrops and flawless practice assaults. But as long as the trusty APN 159 is on speed, we've nothing to worry about. Remember, we can come within 5 miles of real thunderstorms if we have to. I'm sure there's enough room in this big sky to stay at least that far away."

The three grabbed their gear and trudged off the bus. The heavy, humid air always made the bags feel heavier and the walk appear longer than it actually was.

"Isn't it convenient having the terminal snack bar and command post in the same building? Sure makes it easier when you have to kill time waiting on an aircraft."

"C'mon Art, these aircraft we have tonight are the best, we checked earlier when we were spinning flight plans."

"Things can always change, Jack. We still have to check with command post, right Mac?"

"Yeah, let us know what C-post has for us, Mac. We'll be sure and save some carbohydrates for ya."

"Thanks a lot Art. How about ordering me an 'award winning AAFES-burger' and fries? I should be right back."

"Well, what did the providers of information have for us?"

"Nothing too exciting. Basically we're to press as planned. We've got a full formation of healthy birds. There's a distinct possibility they'll have to tap number 3 after the third route to head over to Cubi and preposition for the Kadena shuttles tomorrow. Now, out of my way, my burger is begging for ketchup."

"A lucky night, eh Co? We made our takeoff time with a healthy formation. For that matter, we've got three routes and drops to make it through. Well Nav, how are we doing on time?"

"We're about 28 seconds early, but we'll be losing some time on the next leg."

"Tacky 20 Flight, Command Post."

"Go ahead Command Post."

"Roger sir. Just as we thought, we'll need your number 3 aircraft to press to Cubi right after the third drop. Confirm the third drop is your last actual."

"Affirmative, Command Post. Tacky 23, Lead."

"Roger, Lead, Tacky 23 copied all."

"Crew, Navigator, 10-minute warning. We're about seven miles from our turn point and we'll be heading for the pre-IP on the next leg."

"Nav, I'm surprised you can see anything at all, it's pitch black outside!"

"Don't kid yourself. This is one of those so-called low-level radar routes, despite our being below 5,000 feet."

"Nav, Copilot, I think I see lightning up ahead. You painting anything unusual?"

"Nope, the radar's clean, but I've only got it set for 20 miles. Let me check here a minute. Co, you're right. There is a rather impressive line of thunderstorms at our twelve, but we'll be turning inside it. They're about 26 miles ahead, and we'll be turning in 9 miles."

"I guess that keeps us more than 5 miles away, Nav. Pilot, let's have number 2 formally accept weathership duties to help out the Nav."

"Good idea, Co. I just called them and they were already aware of the weather situation."

"Thanks, Copilot. I'll be monitoring, of course, but I'll need the radar most for alignment on the run-in, which, incidently is coming up soon. We're about ½ mile from the pre-IP. Let's turn now, and we're climbing to 2,000 feet. We'll be looking for a road "Y" at Nambalan. There's no way to pick that out on radar, so we'll be turning on timing for the run-in. You guys got the TACAN on? This is a live heavy load, I plan on using everything at my disposal. I'm breaking out some of terrain features on radar now. Looks like we're about a mile right of course. Let's turn left heading 167°, and timing looks good. Have we heard from CCT yet?"

"Nav, Copilot, I'll call them now."

"Tailpipe Bamban, Tailpipe Bamban, Tacky 20 Flight on time."

"Lead, Two. We're about 13 miles from a *very* large thunderstorm, and the line of thunderstorms it's in parallels the run-in all the way to the drop zone."

"Roger Two. Tailpipe Bamban, Tailpipe Bamban, Tacky 20 Flight on time, how do you read?"

"Tacky 20 Flight, Bamban, loud and clear. Mean effective

winds surface to 500 ft 310 at 6, surface to 1,000 ft 330 at 16, surface winds 300 at 6 gusts to 12. Be advised we've got a lot of thunderstorms in the area, when they pass through we go down to zero-zero with heavy rain. Looks pretty clear in the immediate area for now, you're cleared in on time."

"Roger Bamban, two-zero copies all, we'll report 2 minutes for smoke."

"Lead, Two, the radar shows a solid line of thunderstorms about 6 miles west of the drop zone. You guys can see the lightning as well as we can. What's the plan?"

"Thanks Two, we'll let you know if we come up with any new plans. Well, Art, what do you think?"

"I say we press on in. The thunderstorms are all off to the west, we're radar capable, and we can hedge the run-in a little to the left if we need to. No sense aborting early at the *thought* visibility might drop off. We need to get these drops, and it's better with a route. We're lucky enough to get this first route, and we might have to racetrack the last two drops anyway. I'll tell them, Pilot."

"No, that's okay, I told them we'd advise of any changes in plan."

"The new winds put the drop about 55 yards closer to centerline, and move it back about a second. I'd normally have the drop zone environment in sight by now, but I obviously don't tonight. If you guys break anything out, let me know right away. We look good on radar."

"Hey, what's all this static on the radio? Uh oh, look at the St Elmo's fire on the windshield. Nav, Copilot, what's the outside air temperature?"

"Copilot, Pilot. That makes very little difference now. I've got the aircraft, tell Bamban we're aborting the drop, then call command post. Nav, I need a safe heading and altitude now, and pass it to the formation on Victor 2."

"Roger, Pilot. Let's turn left heading 090°, and climb to 4,500 to avoid the corridor to Clark."

"Tacky 20 Flight, Lead. Echelon left heading 090° now. Clark Approach, Tacky 20 Flight."

"Go ahead two-zero."

"Roger sir. We'll be crossing the approach corridor at 23 DME climbing through 3,800 for 4,500."

"Lucky for you we've already recovered the fighters, you're cleared across."

"Lead, Three. It looks like we were too late. I think we just took a lightning strike to the radome. Once we straighten out, we'll be breaking right and declaring an emergency for our return to Clark."

"How serious is the damage, Three? We're talking to command post now, we'll pass it on."

"Looks like just the radome was fried, and the air conditioning pack has overheated."

"Roger. Tacky 20 Flight echelon right to 167° now. We'll maintain this heading while Three breaks off, then we'll head to San Fernando and hold for a straight-in TACAN 20 approach."

"Well, I guess you're as happy as I am *that* flight's over, eh Mac?"

"Well Art, I think it demonstrates a good point. It isn't *just* the physical limits of the aircraft we need to respect, but every limit. We just weren't as cautious as we should have been. This was just a training flight; we needn't have risked our aircraft and lives that way. The 55-series regulations establish only the minimum acceptable separation from thunderstorms. Like all regulations, they can't cover every situation, that's why we have aircrews—to make judgments. Severe thunderstorms deserve a great deal more respect than we gave them tonight."

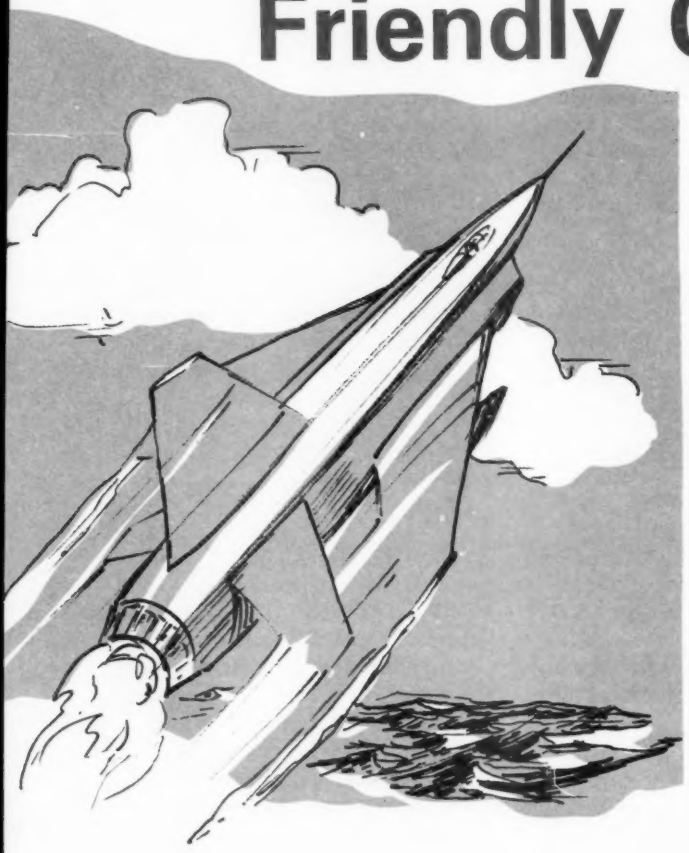
"C'mon Mac, this wasn't just another training flight. We had some very real requirements, and so did the troopers. This was an important mission, and we owe our commander the dedication to make every effort to fly the mission. I don't think we overstepped the bounds of safety at all."

"You're wrong, Art. The very fact we aborted the mission, damaged an aircraft, and *still* didn't get the drops off shows we did exceed our margin of safety. There was a right way. We should have made a positive weather avoidance step when Two told us about the weather the first time. We could have coordinated the run-in farther to the left at a slightly higher altitude, and if it looked good for the run-in inside 5 miles, we could have done it, or run in on an alternate DZ heading. That would have given us an even more realistic "lead" scenario. This one just didn't work out, we'll need another few flights, and I meant *we*. Let's go wrap up the paperwork. I'll buy if you'll fly."

"You're on, Mac."

"... I should be able to see some sky... I could not!"

Friendly Criticism



Mr. Louis A. Driggers
Mercer Island, Washington

Criticism can be devastating! Even light-hearted criticism, often meant to be humorous, can irritate a man, get under his skin, and create serious problems.

Take Tom for example. He was a pilot attached to a fighter squadron based near Los Angeles. This fighter squadron had a social clique exclusively for pilots. As a squadron pilot, you were automatically a member; you flew together, had fun together, drank together, kidded one another, and enjoyed life in the fast lane.

Tom fit right-in this squadron clique. He would stand drink-for-drink at the bar with anyone, arm wrestle, play liars dice and simply be one of the squadron pilots. If you looked into the squadron ready-room you would see Tom laughing and kidding, an active member of the squadron's flight activities.

There was one problem few noticed and no one mentioned. Tom did not like being the brunt of the good-natured kidding and criticism that was a daily part of ready-room banter. It was all friendly, and sooner or later everyone, including Tom, was a recipient, but this ready-room banter bothered him.

I first noticed this after Tom and I flew a hop together, a flight with a bad ending. We had taken off into a hazy Los Angeles sky, climbed rapidly through the smog into clear skies and then leveled off at 25,000 ft. Tom was the leader. I was his wingman, a new pilot in the squadron, just out of flight training. A wingman's job is to simply stick with the leader, no matter what. Tom wanted to see if I would be a good wingman, to see if I would stay with him, so he gave the hitchhiking signal, the signal for a tail chase.

I slid back into position, slightly below and close behind Tom's airplane. When in the correct "tail chase" position I could look right up the leader's tail pipe and watch flames swirling inside his jet engine. I was ready—anxious to show I was a good wingman. I could hold my position. Tom wouldn't shake me.

Tom began by pointing his aircraft down, picking up speed, the air screaming as it rushed past his canopy. Next he pulled up into a steep climb, then rolled onto his side, one wing up, one wing down. He then left the stick alone, not a control moved as the nose sliced gracefully down through the horizon and the scene slowly changed from sky to ocean.

He continued into a steep dive, gathered speed to 400 mph, then pulled into a loop, then around the imaginary barrel for a barrel roll, then a cuban-eight, Immelmann, split S and more. Up, down, around, every which way, every maneuver in the book. We were

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1987 MAC Flight Safety Writing Contest Special Category Winner

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both feeling good, having a good time, pleased with the feeling of the sky gyrating around us, with unlimited three dimensional flight, with the squeeze of G suits as the force of gravity would build up and then the sudden release of gravity and G suit as we would fly into a zero G parabola. It was exhilarating, flying at its best.

To stay with Tom during all this I had to concentrate on his tailpipe and wings. Every little wiggle of his wings was a wiggle of mine, every little change in position of his tailpipe, was a change in mine. Don't look at instruments, airspeed, altitude, or anything in the cockpit. *Just mimic Tom.*

Suddenly—only water was visible in my pheripheral vision. We were headed straight down, fast, with almost full power and all I could see was water, blue Pacific Ocean. If we were above 10,000 ft, our briefed minimum altitude, I should be able to see some sky from the side of my eye. I could not! We were way too low!

Panic flooded through my veins; I was no longer Tom's wing man. I was now trying to save my hide. I closed the throttle, popped the speed brakes full out and pulled back desperately on the stick. The G forces hit like a ton of bricks. The wings flexed, the airplane groaned and I blacked out as blood drained from my brain. My vision returned along with the airplane climbing straight up. I was swallowing hard, trying to wash the bitter taste of fear from my mouth; that ocean had been too close.

Tom was watching his altimeter and was comfortable with the low altitude. He pulled up without panic, a normal recovery from a dive.

I had overstressed my airplane and returned to the airport very gingerly. The damage turned out to be minor but the ready room criticism was major—of me about my panicky pull-up and of Tom for taking us so low.

As a new pilot I was expected to make mistakes. But Tom was an old hand, an experienced pilot, one who should not make such mistakes. The ready room criticism bothered him. Oh, he wouldn't show it, he wouldn't let on that it bothered him. He received such banter with dignity. But if you knew him well, if you looked close, you could tell. Tom was a very sensitive man, a proud man who did not like to be criticized.

There were also other ways to be the brunt of ready room banter. For example, taking a wave-off. If a pilot flew an approach in such a sloppy manner as to require a wave off, he was going to be the recipient of some ready room kidding, no way out of it. The wave-off was always done at the airport in front of everyone and there was no way to wiggle out of being the guilty party.

Obviously, the wave-off was a proper and safe maneuver. Much safer than continuing a sloppy approach. Wave-offs were encouraged by the squadron commander and the safety officer, to little avail. A wave-off was an ego-jarring insult and pilots would do so with extreme reluctance.

A few months passed and Tom and I were again in the air for another flight. We were part of a large formation flying over a parade, part of a Fourth of July celebration.

Tom and I flew wing for the leader of the formation. I was on the left wing, Tom on the right, and Smitty flew the slot. We were the first diamond formation over the parade and the first to return and land. We flew over the airport in an echelon and split up for our landings in order: Lead, myself, Tom and Smitty.

During my approach and landing I noted the Los Angeles smog had reduced visibility in the landing pattern, it was hazardous, it paid to be careful.

I taxied in, climbed out of the cockpit and looked back—there was a dense cloud of pitch black smoke piercing the sky with an intensity that means a crash—a fire—a lost friend!

It was Tom. He had flown a terrible approach. *He did not do a wave-off!*

Mr. Louis A. Driggers completed Naval Flight Training in 1955 and served in a Marine Fighter Squadron until 1958. He joined Northwest Airlines in 1959 and flies a 747. For fun, Mr. Driggers flies a Citabria and a Christen Eagle.

Excellence In Airmanship

From left to right: Lt. Col. Hoyback, Lt. Col. Jenkins, Lt. Col. Pennington, Capt. Cantrell, SSgt. Polesnek, SMSgt. Stauffer, MSgt. Williams, Sgt. Davidson, SMSgt. Presson, Sgt. Brass.

Lt. Col. John P. Hoyback and Crew, 20 MAS, Charleston AFB, South Carolina, quickly responded to an in-flight emergency during a joint airborne/air transportability training mission at Pope AFB, North Carolina, on 18 Mar 1987. Cabot 42, a single-ship C-141, was flying a routine heavy equipment drop. The copilot activated the air-delivery switch and the load, a two-platform sequential train consisting of an Army gamma goat and a 155 mm howitzer, malfunctioned exiting the ramp. The gamma goat upended as the extraction chute pulled it from the cargo bay, causing extensive damage to the aft part of the aircraft. The cargo ramp and petal doors jammed open, the tail cone assembly and yaw damper tore from the aircraft, shattering number 1 hydraulic system lines, denting the rudder pack, and extensively damaging sheet metal. The loadmaster, SMSgt. John R. Stauffer, Jr., called "Malfunction-Load Clear," the scanner, MSgt. Alfonzio Williams, advised the AC of the damage, while SSgt. Michael Polesnek, Jr., took corrective actions to minimize effects of the lost hydraulic system. The pilot began a turning drop zone escape to avoid populated areas and directed the copilot, Capt. Cantrell, to reposition flight control switches. After evaluating the aircraft's overall status, Colonel Hoybach elected to recover at Charleston AFB, South Carolina. After a controllability check, the AC flew a modified approach to help prevent further damage on landing. A minimum deck angle to a near three-point landing was necessary to

prevent the open ramp and petal doors from impacting on touchdown. The scanner strapped himself down in the cargo compartment to observe the flare attitude and provide information to the AC. The approach and landing were letter perfect—neither open ramp or petal doors touched the runway. The rollout and taxi were uneventful. This crew's outstanding handling of a dangerous situation resulted in safe recovery of the aircraft and prevented additional damage. *TMF* staff extends its congratulations for a job well done.

Lt. Col. Charles I. Arms and Crew, 1 MAS, Andrews AFB, Maryland, displayed outstanding airmanship on 19 Jan 1987, during a flight from Bangor, Maine, to Andrews AFB, Maryland. At 4,000 ft on approach to Andrews AFB, their C-20 encountered occasional light to moderate turbulence and rain showers. Approximately six miles from the field on a radar downwind, the nose of their C-20 was struck by lightning. A blinding white flash was followed by a loud explosion and concussion and the aircraft's radome and radar antennae separated from the aircraft. Cockpit communications were hampered by a 230-knot wind buffeting the now-blunt front end of the aircraft. The AC managed to coordinate the crew's actions while the copilot flew the aircraft, which now was without airspeed indications, radar, or autopilot systems. Using ground speed readouts from the INS and known power settings, the copilot maneuvered the aircraft for an extended ILS final while evaluating the aircraft's controllability. After a final weather check, Colonel Arms gave the go-ahead for landing at Andrews. After configuring for landing, the AC landed the aircraft safely and smoothly. The professional skill and airmanship displayed by this crew deserve recognition with the Excellence in Airmanship Award. *TMF* staff salutes this deserving crew.

From left to right: Lt. Col. Arms, Capt. Chang, TSgt. Cosgrove, SSgt. Monroe, and SSgt. Molina.

Mishap With A Moral

Critical Failure

Every time a pilot straps on an airplane and pushes buttons bringing his machine to life, he or she meshes a combination of training, education, practice, and experience. A lack in any area, or an inability to focus this combination on the right area at the right time, can lead to a critical failure; the failure that leads to disaster.

At 1521 Central Daylight Time (CDT), 6 September 1985, Midwest Express Airlines Flight 105, a McDonnell Douglas DC-9-14 airplane, crashed in an open field at the edge of a wooded area about 1,680 ft southwest of the departure end of Runway 19R shortly after takeoff from General Billy Mitchell Field, Milwaukee, Wisconsin. Weather was clear with visibility 10 nm. During initial climb, about 450 ft above ground level (AGL), there was a loud noise and a power loss associated with an uncontained failure of the 9th and 10th stage high pressure compressor spacer of the right engine. Flight 105 continued climbing to about 700 ft AGL, then rolled right until the wings were observed in an approximately 90 degree right banked turn. During the roll, the airplane entered an accelerated stall. The airplane was destroyed by impact forces and postcrash fire. The pilot, first officer, both flight attendants, and all 27 passengers were fatally injured.

ANALYSIS

The National Transportation Safety Board (NTSB) evaluated performance characteristics of the DC-9-14 airplane following an abrupt power loss from the right engine during takeoff and found the airplane docile, easily controllable, and requiring no unusual pilot skills or strength. Therefore, the NTSB went on to examine those factors which might cause the pilots to lose control, including the possibility fragments of the right engine separated with sufficient energy to cause critical damage to the airplane's flight control system; the possibility of control system malfunction(s) which could have rendered the airplane uncontrollable; and the possibility of inappropriate flightcrew response to the emergency.

Flight Controls

After a thorough examination of the flight controls and possible damage scenarios, the Board concluded engine parts probably didn't strike the aircraft after ejection from the right engine. If any engine parts did strike the aircraft, they didn't cause damage of any consequence. There was, therefore, no basis to conclude flight controls malfunctioned or were damaged in flight. All flight control systems were apparently available to the flightcrew following abrupt loss of right engine power.

Flight Crew

Both pilots met Federal Aviation Administration (FAA) requirements applicable to their respective crew positions. Both had received upgrade training, which led to Midwest Express DC-9 captain qualification.

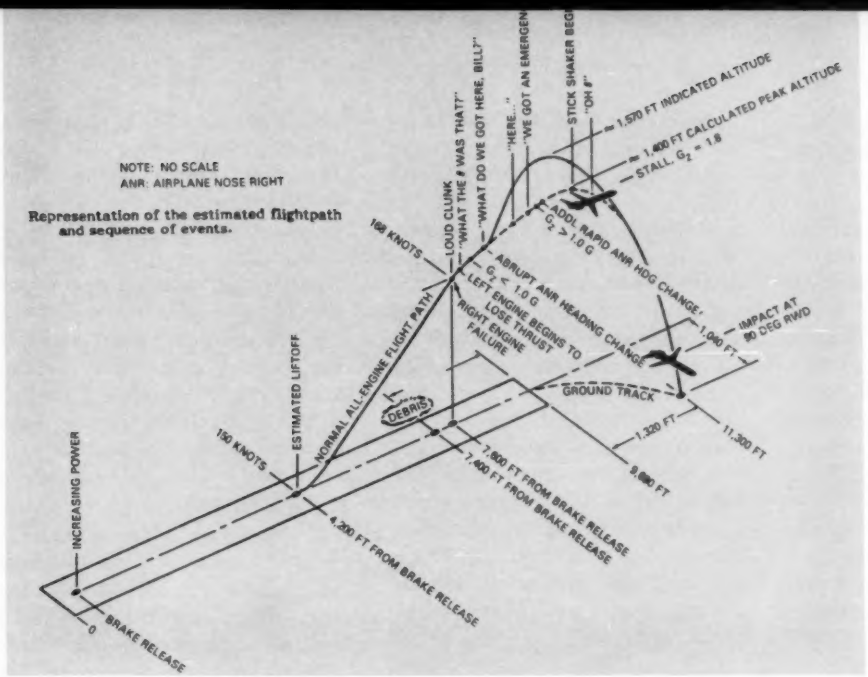
Company records indicated the captain had 5,100 hours, including 1,100 hours in the DC-9-14 and 500 hours as captain. All his turbojet experience was in the DC-9-14. Before flying with Midwest Express, the captain was a corporate pilot flying the Beech 90 turboprop Kingair. He'd logged 2,900 hours in the Kingair, including 800 as pilot-in-command. According to Midwest Express, he had 104 hours total instrument pilot experience when hired.

At the time of the accident the first pilot had 5,197 hours total flight experience, including 1,640 in the DC-9-14, and 1,140 hours as DC-9-14 captain. He had previous turbojet experience as a U.S. Air Force F-4 pilot. The first pilot was also a check airman, authorized to conduct proficiency and line checks in the DC-9 airplane and flight simulator.

A review of both pilots' recent activities revealed no evidence of medical problems or life situational stress problems present at the time of the accident. Their eating and resting habits weren't unusual.

Flight Crew Training

The captain's most recent simulator proficiency check was performed 6 February 1985, at Republic Airlines, and his most recent DC-9 line check was performed by a Midwest Express check airman on 6 March 1985. He completed recurrent DC-9 ground training on 11 May 1985. The captain's simulator training records



reflected "Takeoff with Simulated Powerplant Failure" was practiced in 12 sessions, "Approach to Stalls" practiced in 12 sessions, and "Powerplant Failure/Fire" practiced in 10 sessions. His flight instructor at Republic Airlines said the captain practiced one simulated engine failure on takeoff during a training flight, but FAA records indicated he was not checked on that maneuver in the airplane during his type-rating checkride.

The first officer's most recent proficiency and line checks were completed 26 August 1985, and 21 March 1985, respectively. Both checks were conducted by Midwest Express check airmen. The first officer's most recent DC-9 ground training was completed 10 November 1984. Training records indicated the first officer practiced "Takeoff with Simulated Powerplant Failure" in 15 simulator sessions, "Approaches to Stalls" in 12 simulator sessions, and "Powerplant Failure/Fire" in 14 sessions. His flight instructor at Republic Airlines said he gave the first officer a simulated engine failure during climbout at least once in the airplane. He did not recall details of the flight, but said he normally simulated an engine failure after takeoff in the airplane at 300 to 500 ft AGL by retarding the throttle to a point (above 67 percent N2) where the engine would not unspool.

Neither pilot had experienced an engine failure in his DC-9 line flying experience. Both pilots "trained to proficiency" during captain upgrade training at Republic Airlines and were considered by their peers and instructors to be excellent pilots.

Midwest Express did not provide its pilots with a specific course on cockpit resource management (crew coordination), but training and management personnel stated the applicable principles were stressed in training each pilot.

The NTSB concluded the stall occurred because the flightcrew didn't correctly diagnose the emergency's nature, applied incorrect rudder control about 4 to 5 seconds after right engine failure, and applied nose-up elevator control, increasing "G" loads. The nose-up elevator control input would have been a normal response to correct for the pitch-over maneuver and reduction in pitch attitude precipitated by the rudder pedal induced roll and was consistent with rapid airplane deceleration. The rapid deceleration would have resulted in a vestibular perception of downward pitching of the airplane nose.

How could two, evidently well-trained pilots, be overcome by an admittedly serious, but normally controllable, emergency? To answer this question, the Board closely examined training the pilots received in the DC-9 simulator and characteristics of the simulator itself.

Much of the Midwest Express-required flight training was performed in an approved, 3-degree of freedom simulator. Differences between the simulator and airplane cockpit were minor and addressed in training. The Board found visual flight simulators have limitations in reproducing the engine failure emergency as experienced in an airplane since peripheral visual cues, certain onset motion cues, and aural cues were absent in the simulator. This

characteristic was not unique to the Republic Airlines simulator but was common to all visual flight simulators.

Because of a lack of consistent results in behavioral science research on simulator motion, the Board could not attribute performance failures of the pilots of Flight 105 to the lack of high fidelity yaw motion cues in the visual simulator. While the simulator lacks the immediate kinesthetic yaw motion cues from thrust asymmetry in the airplane, it does replicate long term lateral acceleration motion cues resulting from an engine failure, so cues presented are similar to airplane response. Although the pilots of Flight 105 may not have experienced the exact kinesthetic and visual cues in their simulator training, the Board believed they should have been able to recognize and analyze the emergency based on cues present.

The Board was concerned about the possibility the type of training given in the simulator, rather than the limitations of cues provided in the simulator, could have been a factor in the flightcrew's performance.

In a yawing condition, visual stimuli, which typically produce relatively slower reaction times than aural or kinesthetic stimuli, may enhance perception of yaw since the pilot normally could see the airplane nose moving sideways relative to objects in his field of view.

In the most common type of simulated powerplant failure, the V_1 (takeoff decision speed) engine failure, external visual information alone is generally sufficient to inform the pilot of the occurrence, since the airplane is either on or only slightly above the runway. Airplane nose movement, relative to runway centerline, provides adequate information an engine has failed. As a result, training in recovery from an engine failure at or just after V_1 might lead pilots to rely extensively on forward visual cues, even if peripheral visual cues are present. If peripheral information is absent, as in the simulator, repeated training in V_1 failures in the simulator can result in exclusive use by pilots of visual information presented straight ahead, outside the cockpit.

In this accident, there were no forward external visual references since the sky was clear. When the engine failed, the airplane would have been in a nose-up attitude of about 12 degrees and the pilots, had they been looking outside the cockpit, would have been looking at the sky.

In the absence of clouds, there would have been no visual cues straight ahead to provide the pilots information needed to perceive the airplane's immediate right yaw following right engine failure. Consequently, the only external visual cues indicating a yaw available to the pilots would have been ground-based information presented peripherally, *or the flight instruments.* Peripheral clues are of relatively little use for detection of airplane yaw because angular rates of stimuli in the periphery are generally too low to be readily apparent. The Board believed more effective scanning of flight and engine instruments by the pilots of Flight 105 would have enabled them to maintain airplane control and properly evaluate powerplant failure.

The Board concluded infrequent training for an engine failure at low altitude in the initial climb phase of flight could have left the flightcrew ill-prepared to cope with the emergency. Although analyzing abnormal or emergency situations and maintaining airplane control by reference to flight instruments are basic elements of airmanship, the Board believed FAA and the airline industry should consider the circumstances of this accident with a view toward including scenarios of engine failure after takeoff climb establishment in training programs to better prepare pilots for such emergencies. Consideration should also be given to reducing pilot reliance on external visual cues during "V_1 cut" training by making greater use of simulated low visibility situations during such training.

PROBABLE CAUSE

The National Transportation Safety Board determined the probable cause of the accident was the flightcrew's improper use of flight controls in response to catastrophic failure of the right engine during a critical phase of flight, which led to an accelerated stall and loss of airplane control. Contributing to the control loss was a lack of crew coordination in response to the emergency. The right engine failed from the rupture of the 9th and 10th stage removable sleeve spacer in the high pressure compressor because of the spacer's vulnerability to cracks.

APPLICATION TO MAC

Professional airmanship demands proficiency in basic instrument flying. The pilots in this case evidently relied on external visual cues rather than on the only reliable indicators available; their instruments. The first rule printed in any flight manual pertaining to emergencies is *MAINTAIN AIRCRAFT CONTROL.* You can't do that reliably by depending on outside references or trying to identify strange sounds or vibrations felt through the seat of your pants. At some point, most emergencies demand the focus of your concentration shrink to one basic skill and one basic instinct: Instrument flying and survival. ✈

Adapted from: NTSB/AAR 87/01

Start at the weather shop

Big CAT Hunting

"Cennntterrr, ittt'ss getttiinnng a litttllle rough uppp heeerrre . . ."

Sound familiar? Just about all of us have experienced at least one encounter with clear air turbulence (CAT). According to the weather folks, CAT generally refers to turbulence caused by a relatively strong vertical or horizontal shear in speed or direction. Turbulence associated with convective activity isn't considered CAT. Although CAT usually occurs in clear air, it's not limited to cloud-free skies. CAT can occur in the vicinity of jetstreams, upper air closed lows, sharp troughs, areas of strong thermal advection, or an advancing cirrus shield.

That last sentence contained some fancy weather terms, but we aren't trying to train new weathermen. We're trying to give you some basic information to help you spot and avoid possible CAT areas when you look at the weather info supplied by your friendly forecaster.

Wind Patterns

In the early 1960s, United Airline's Meteorology Department developed a basic jetstream model (Figure 1). They associated CAT with the polar jet, converging jets, mountain waves, and the subtropical jet. They also estimated CAT probability.

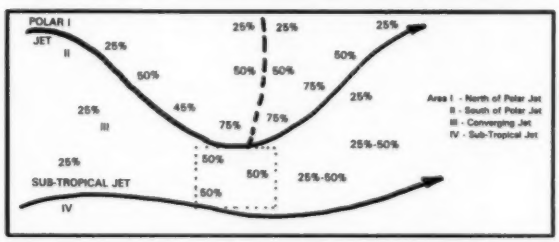


Figure 1. United Airlines jetstream model depicts basic jetstreams and probabilities CAT will occur. That is, a flight through the box has a 50 percent chance of encountering CAT. Probabilities aren't cumulative. For CAT to occur, you need horizontal wind shear greater than 40 knots in 150 nm or vertical wind shear greater than 6 knots per 1,000 feet.

CAT and Upper Air Ridges

In one study, 60 percent of moderate or greater CAT over the North Atlantic was observed with anticyclonically (clockwise) jets, while 30 percent was associated with sharp troughs. You can expect at least moderate CAT on both sides of the jet where it undergoes maximum latitudinal displacement in what's called an amplifying ridge (Figure 2). Maximum CAT occurs in the area of greatest anticyclonic curvature (usually within 250 nm of the ridge axis and elongated in the direction of flow).

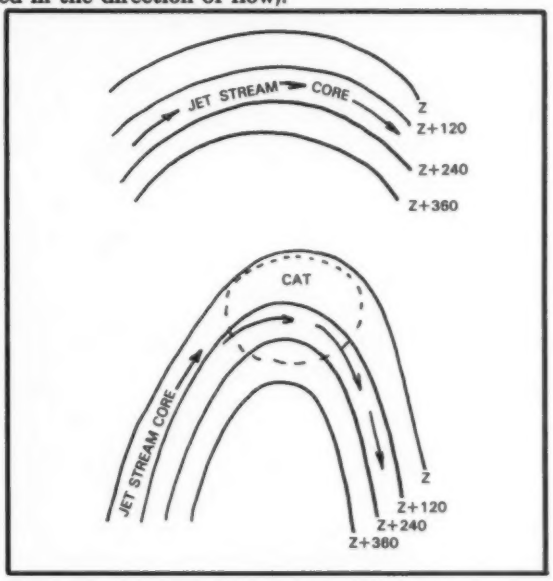


Figure 2. CAT in an amplifying ridge.

Expect moderate or greater CAT with strong vertical wind shear 10 knots/1,000 ft, winds 135 knots in an area of large anticyclonic curvature, or a large latitudinal displacement of the jet with winds 115 knots.

Turbulence with Confluent Jets

When two jets converge within 250 nm, potential for CAT increases. Since the poleward jet is associated with colder temperatures, and is lower in altitude than the second jet, the poleward jet will often undercut the second jet. This increases static stability and produces strong vertical wind shears. Figure 3 shows the potential CAT area at the point where two jets come within 5 degrees latitude of each other and ends when the jets start to diverge.

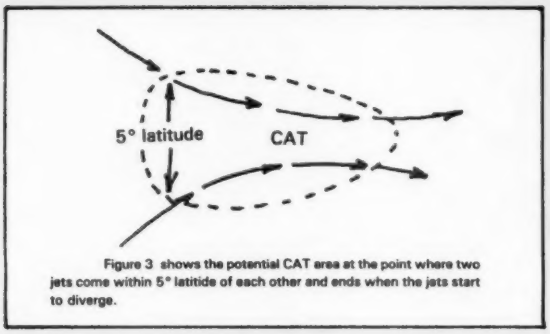
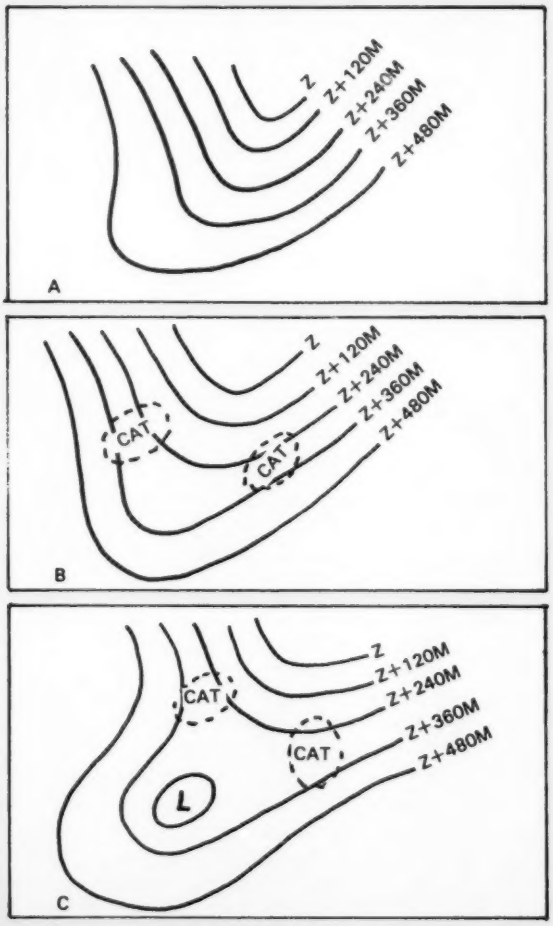

5° latitude
CAT
Figure 3 shows the potential CAT area at the point where two jets come within 5° latitide of each other and ends when the jets start to diverge.

Figure 3. CAT associated with confluent jets.

CAT and Upper Level Lows

As a cutoff low develops, there's a potential for at least moderate CAT. The sequence of Figure 4a-d shows CAT likely in areas of confluent and difluent flow. Once the low is cutoff, CAT intensity will diminish to light in the area of the low.



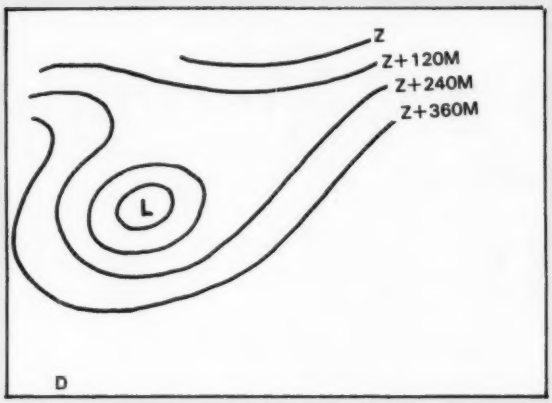


Figure 4. CAT and the development of a cutoff low.

CAT and the Shear Line in the Throat of Upper Air Low

When the jet is strong around a closed low and there is a very narrow neck between the prevailing flow around the low, there's a potential for moderate CAT, provided wind speeds are 50 knots. If speeds reach 115 knots, expect moderate to severe CAT. CAT potential is greater between the two anticyclonically curved portions of the jet (Figure 5).

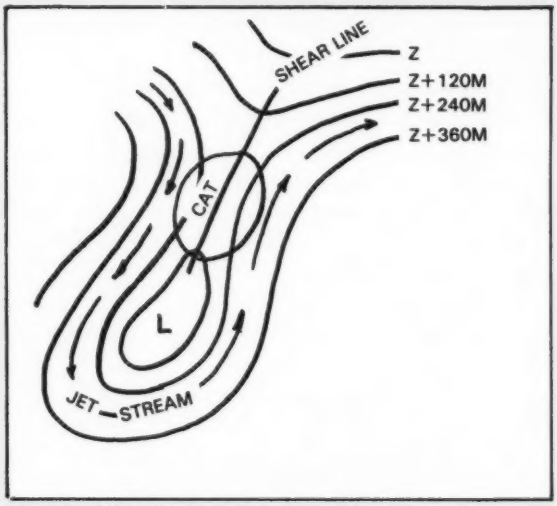


Figure 5. CAT in the throat of an upper air low.

CAT and Difluent Wind Patterns

Most CAT occurs during difluent pattern formation. After the difluent pattern is established, CAT weakens in the difluent zone. When difluent wind patterns exist aloft, CAT probability is low. However, when a surface front is present, CAT potential increases in areas of difluent flow near the surface system (Figures 6a and 6b).

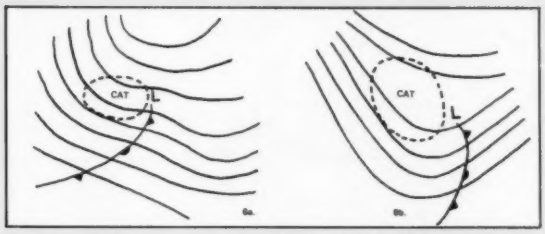
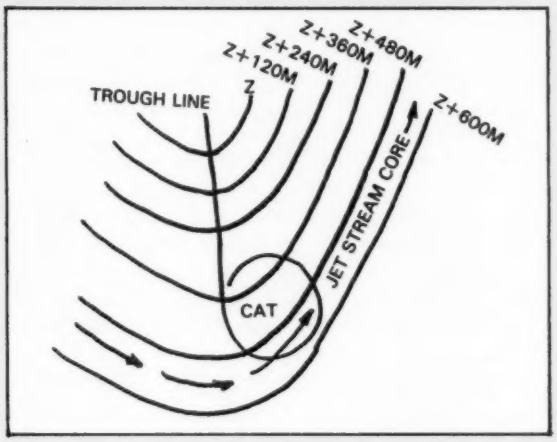


Figure 6. Relationship of CAT to difluent wind patterns and surface systems.

CAT and Shearing Trough

Rapidly moving troughs of a quasi-stationary jet produce CAT potential in the confluent flow at the trough base. The CAT area is just north of the jet stream core and downwind side of the trough line's southern portion (Figure 7).



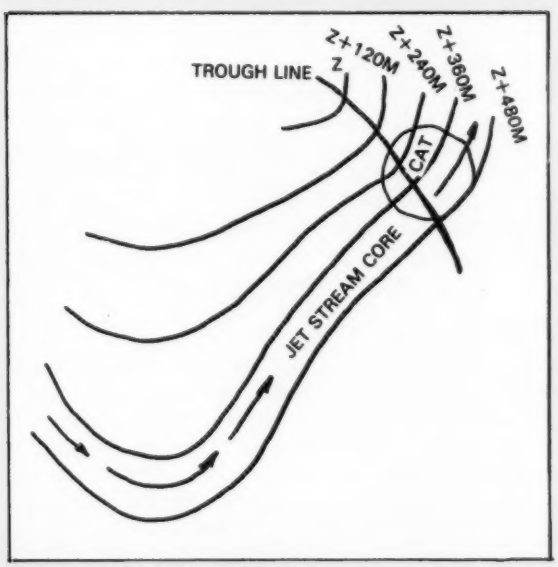


Figure 7. CAT in a shearing trough.

CAT Associated with Strong Maximum Wind to the Rear of an Upper Trough

When a strong north-south jet is located along the back side of an upper trough, CAT potential is high. The CAT potential is in the area of decreasing winds between the trough base and maximum wind upstream. CAT will most likely occur if the wind speed change is 40 knots within 10 degrees latitude. If the difference between jet core and minimum is 60 knots, CAT is most likely to occur between the jet core to the trough base and centered on the jet's warm side.

These are just some of the basics of Clear Air Turbulence prognostication. We need to understand conditions that can generate CAT and make sure we ask the right questions. Those little weather maps the forecaster hands us aren't just pocket fillers. There's a lot of good information on them, a little study, a few questions, and an attentive ear can make for a more comfortable and safer flight.

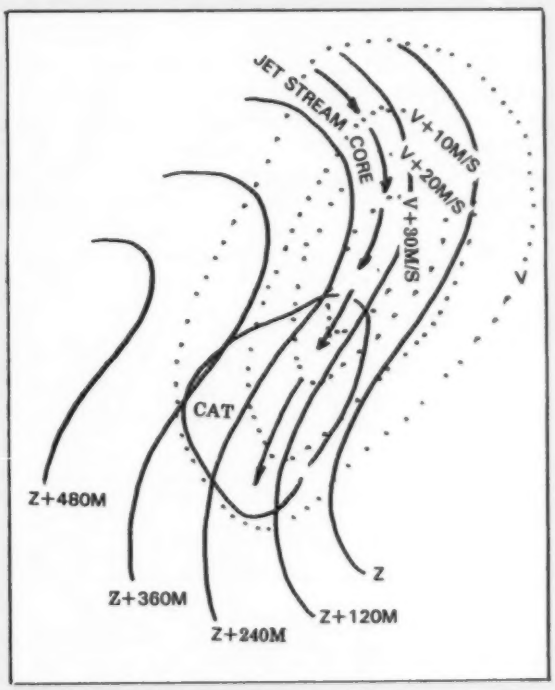


Figure 8. CAT with strong wind maximum behind an upper trough.

Adapted from: AWSP 105-56.

Weather Avoidance

Using Airborne Radar

You spend time studying and practicing Dash One procedures, instrument approaches, and ATC procedures. When was the last time you reviewed AFM 51-12, Vol I, *Weather for Aircrews?* A professional pilot must have a knowledge of weather; especially its effect on aircraft operations.

Successful encounters with thunderstorms begin with a thorough knowledge and understanding of thunderstorm characteristics and structure. There are many sources of information on this subject. AFM 51-12, VOL I, Chapter 13, is a good place to start. Aircraft with airborne radar have an obvious advantage avoiding thunderstorms. Radar allows you to circumnavigate potentially dangerous cells. However, it does not guarantee success. It may keep you out of the strongest cell, but the innocent looking cell you decide to penetrate may pack a punch that exceeds structural limits of your aircraft. Any thunderstorm is dangerous. Successful flight near thunderstorms, with airborne radar, depends on three factors: radar set calibration, knowledge of radar principles, and skill in interpreting the radar scope.

The first factor, radar set calibration, is beyond your control except that you write malfunctions in the aircraft forms. If the set is not calibrated, you will not be able to compare radar returns from one day to the next. Scope interpretation is a very subjective process. Without an accurate reference level, your previous experience will be of little use in your decisions.

The following principles apply to all airborne radars. Your particular set may be more sophisticated, but time and space do not permit detailed examination of specific radars. Let's begin by examining beam width.

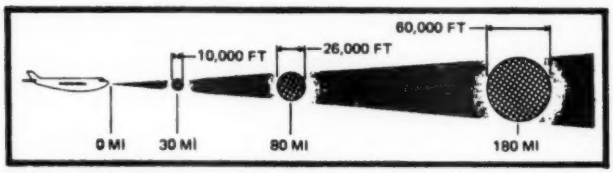


Figure 1. Radar beam cross-section illustrating width at 30, 80, and 180 nautical miles.

—BEAM WIDTH. Radar beam width in most airborne radars is a 3-degree pencil beam able to define size and shape of thunderstorm cells at varying distances. Radar beam cross-section size increases significantly as range increases. Figure 1 illustrates width of a 3-degree beam at 30, 80, and 180 nautical miles.

Beam characteristics account for the phenomena of "splitting cells." As you approach an area of thunderstorms, a cell may appear to split and form two separate cells. Although actual splitting may occur occasionally, in the majority of cases this is only an illusion caused by the finite width of the beam. For example, beam width at 180 nm is approximately 10 nm. If there are two cells closer than 10 nm apart, they will appear as one cell. As you get closer, they appear to split as the beam width decreases to a width less than their combined size. If the beam must penetrate precipitation it will be displayed as if the entire beam were "filled" with precipitation targets. The target displayed on the scope will not appear to become weaker prior to splitting into two targets.

—ATTENUATION. Attenuation is a reduction of energy in a radar beam due to absorption. Of particular importance to aircrew is attenuation caused by precipitation. Strong cells can be masked by other cells that lie between your aircraft and the strong cell. Figure 2 illustrates effects of attenuation. The left side of cell A appears to have a weak return. This is due to attenuation by cell B. Be suspicious of weak returns that appear behind other cells.

—RANGE EFFECT. The power of reflected energy received back at the radar set is inversely proportional to the square of the range. For example, if you observe two cells of equal intensity, one at a range of 10 nm and the other at 20 nm, the cell at 10 nm will appear four times stronger. This is why cells sometimes appear to become stronger as you get closer to them. Many radar sets use a Sensitivity Time Control (STC) to compensate for range effects. All echoes of the same intensity displayed within the STC range

will have the same intensity displayed on the scope. Know your set.

—GAIN AND INTENSITY. Gain and intensity controls can be very helpful if used correctly. Gain and intensity controls are usually set at a standard setting. If, for some reason, you must penetrate an area of strong cells, reducing gain and intensity will have the effect of eliminating all but the most intense thunderstorms. On the other hand, if you want to avoid all areas of precipitation, increasing gain and intensity will enable your set to display weaker cells.

—CONTOURING. Contouring is the radar set's ability to blank out signals above a preset value. The most intense part of the cell can be blanked out, allowing easier identification of potentially turbulent areas. This feature is of limited value since it does not provide a quantitative measurement of intensity. However, contouring does show the gradient of precipitation intensity. Figure 3 is an example of contouring. A gradient is the change of a property over a specific distance. The gradient between A and B is much greater than the gradient between A and C. A tight gradient usually indicates an area of turbulence because it's an area of weak vertical motion adjacent to an area of strong vertical motion resulting in wind shear.

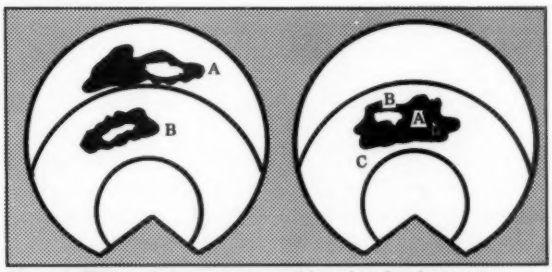


Figure 2. Effects of attenuation caused by other thunderstorms.
Figure 3. Contouring pattern illustrating precipitation.

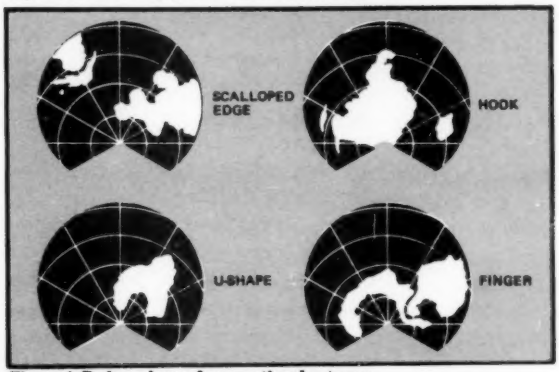


Figure 4. Radar echoes of severe thunderstorms.

—TILT CONTROL. Thunderstorm intensity varies significantly throughout the vertical extent of a cell. The strongest updrafts occur in the mid-levels, between 18,000 and 30,000 feet. Changing antenna tilt will ensure potentially hazardous areas won't go undetected.

Radar returns indicate intensity of precipitation, not severity of turbulence. Radar measures reflectivity of precipitation. Large drops reflect more energy than smaller drops. Hail, which is covered with a thin layer of water, reflects still more energy. Large water droplets and hail exist in strong updrafts. We can generalize that areas of strong radar returns are indicative of turbulence. There is no rule of thumb correlating strength of return with severity of turbulence. Beware! One day you may penetrate a strong return and not feel a thing; but your next penetration of a weak area may result in a turbulent encounter.

The best way to avoid severe weather associated with thunderstorms is to effectively use airborne radar. Your ability to successfully circumnavigate potentially dangerous thunderstorms depends on your scope interpretation skills. Scope interpretation is extremely subjective. Improving your skill requires a detailed knowledge of thunderstorm structure and the capabilities of your radar.

Experience shows there is a good correlation between certain radar echoes and hail, severe turbulence, and tornados. Figure 4 illustrates these echoes: a scalloped-edge echo is a good indication of a rapidly changing and potentially severe thunderstorm. Finger shaped appendages are good indicators of hail. The hook-shaped echo is an indication of a possible tornado. Most tornados occur below 5,000 ft, so you must tilt your antenna down to detect a hook echo if you are above 5,000 feet. The cyclonic circulation associated with a tornado extends throughout the thunderstorm.

Avoid all cells by at least 20 nm. Outside the cloud, hail, wind shear turbulence, and lightning have been encountered several thousand feet above and more than 20 nm laterally from a severe storm.

Airborne radar is a definite asset when circumnavigating thunderstorms, but don't be lulled into a sense of false security because you have airborne radar. Any thunderstorm packs enough energy to destroy any aircraft if you fly into the wrong area at the wrong time. Airborne radar helps, but it's not a substitute for tempered judgment. Be prepared. Review your AFM 51-12, VOL I, for the capabilities of your airborne radar and thunderstorm avoidance procedures and your particular 55-series regulation for thunderstorm avoidance criteria. ✯

Adapted from: Aerospace Safety

We're here to help!

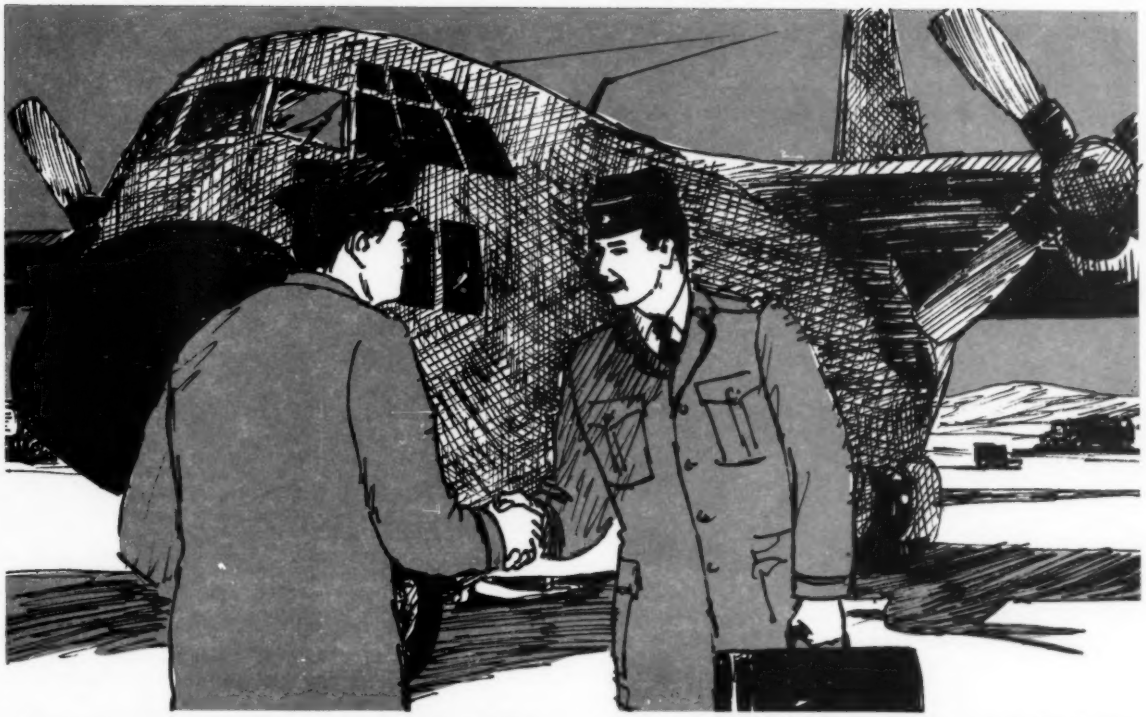
Here we are with yet another provocative installment of things you thought you'd learn at school, but didn't. This month we'll tackle an integral, yet particularly vague portion of flight safety— inspections and evaluations. We'll begin with a look at what the *new* AFR 127-2 tells us about these safety subjects. With that as a base, we'll point out some interesting techniques we've seen using inspections and evaluations as a safety tool. Let's begin.

The new AFR 127-2 addresses inspections, evaluations, and staff assistance visits just as the older, more familiar edition did. Chapter 6 is the operative chapter, although it's not the only place they're discussed. Chapter 4 also mentions these topics and Chapter 13 identifies flight safety-specific inspections. It would be a colossal mistake to try and base your evaluation program on what's identified in Chapter 13 alone; after all, it just says you'll evaluate your subordinates once a year. The authors explain evaluation details in Chapter 6, and don't repeat them in sections outlining individual safety program elements.

We'd like to make a distinction here between inspections and evaluations. Inspections, as we see them, deal with physical entities, light bulbs, storage areas, walkways and the like, or adherence to procedures. Evaluations, on the other hand, deal with program management. Flight safety officers deal with both, but primarily with evaluations. First mentioned in Chapter 4, evaluations are a deeply rooted safety requirement. That's about all it says there. Chapter 6 gives an expanded explanation. Here the authors give us our first clue about what we're really expected to do.

If you look in Chapter 4, you'll see it's your responsibility to first educate subordinate units on what's expected, advise them on how you'd like them to do it, and then help them comply. So when you walk into your squadron FSO's office, shake hands, and say "I'm here to help," you really should be! Your program evaluation outbrief and report really reflect just how well the *whole* safety program is doing, including yours.

Evaluations, then, turn out to be yet another safety tool. Whether we use the information or not,



they measure our own performance, especially when we don't do them carefully enough. Evaluations are far too valuable to be used as a forum for public admonishment or gratuitous backpatting. A report that tears up a safety program, without powerful, useful recommendations for corrections, is as useless as the "sunshine report," (you know—all glowing remarks, requires sunglasses to read). We began by describing safety inspections as particularly vague. They have to be, from a regulatory perspective, because they *must* be tailored. Not only must they fit the unit and mission, but also changing circumstances of the environment in which we operate. Just as special interest items (SIIs) come and go, some areas require emphasis at one time of year for example, and different areas at another. You should know, before the inspection, what areas need the most attention. Hence, the "sunshine report" often indicates the inspector was unfamiliar with the "inspectee's" area of responsibility. On the other hand, a report reflecting enormous problem areas with little hope of recovery, save starting over, certainly holds the implication of long-term neglect from the parent organization. As usual, most reports fall somewhere between these extremes, as units are rarely flawless or devoid of safety practices.

We believe inspections merely formalize your ongoing efforts to remain aware of what your subordinate safety offices do, and how they do it. This leads us nicely to our next point about evaluations—exactly what are you going to evaluate? You're undoubtedly familiar with your subordinate unit's responsibilities, at least in a general way, but what about all the details covered in Chapter 6 of AFR 127-2? There are at least 17 different areas listed! Well, we conclude it's no coincidence those 17 recommended areas resemble wording you'd find in an evaluation checklist, primarily because we strongly agree a good checklist is a prerequisite for a productive evaluation. So the next obviously leading question is: Where do you get the checklist? There are a number of sources, most, we hope, aren't too big a surprise.

You could always use the areas discussed in Chapter 6 as a foundation for your checklist. But that's only a skeleton; you'll need to tailor your checklist to the unit. One way is to pull out AFR 123-1 MACSUP 1, Chapter 12. If you don't already have a copy in your office, shame on somebody! No, it's not a pure safety regulation, but you'd have one heck of a time trying to convince anybody it doesn't affect your program. Since that's how the IG evaluates programs, it's probably safe to pattern *your* evaluation to the one described. Another place you can find input for such a checklist is in ORI/UEI reports. While listing the problem areas of other units, they also provide IG interpretation of items found in AFR 123-1.

Now you've got a pretty good idea of the types of things you need to look at, so this is a good time to start. An effective final step we've seen is to sit down face-to-face with future inspectees and work out checklist questions with them. It will take a little longer than if you just sat down alone and wrote them out; but it has side benefits. It will insure the other participant in your evaluation is thoroughly familiar with requirements and insures those you include are realistic for the unit involved (they'll let you know if one of your ideas isn't a player for them—trust us).

AFR 127-2 also discusses inspections, and pretty much in the same places. Chapter 4 tells you to do them, and Chapter 13 tells you what to spot inspect, i.e. "high interest" areas. (It also mentions you must monitor a whole list of areas discussed in greater detail in the June installment of this series). By now you know what the high interest areas are, and you know you need to inspect them. What does that mean? Once again, Chapter 6 of 127-2 comes to our aid. Paragraph 6-2 tells us the purpose of inspections. We liked the words so well we're reprinting them for your viewing pleasure:

> "Functional managers and supervisors are responsible for providing safe work areas and for making sure their people know and comply with safety standards. Through inspections, the safety staff helps the commander determine the condition of work areas, the degree of compliance with standards, and the safety of work practices."

And just what, you may be asking, makes *that* quote so exciting? It very subtly lays responsibility for areas you're inspecting where it ought to be—on you. As a safety officer, your job (since you chose to accept it) is to implement the commander's safety program.

As we mentioned earlier, you're responsible for helping subordinate units know what's expected, then helping them comply. Your inspection report (most likely a spot inspection) will probably not be a part of an evaluation report. Just like your evaluation report, however, it needs to be objective, realistic, and geared to problem *solving*.

A change in this edition of the regulation requires high interest areas be spot-inspected monthly. While that might appear excessive, remember spot inspections require less documentation than a formal report. If you find problems, a report identifying the discrepancy needs to go where it will help solve the problem—the supervisor. And, of course, there's the ubiquitous "follow up" requirement which is a part of almost every safety endeavor.

A last note in this area describes staff assistance visits. Usually, staff assistance visits imply a headquarters higher than wing level, but feel free to conduct them yourself. In fact, you should be doing this frequently, since all a staff assistance visit really does is help solve a problem. That should describe your routine relationship with your subordinate units.

Used in the proper spirit, evaluations won't harm your program management in any way. Evaluations won't be dreaded visits from "they," in the eyes of your subordinate unit safety staffs, and they'll be much more than just another square to fill for your program. Evaluations, inspections, and staff assistance visits serve a kind of "spring cleaning" purpose; they uncover all program elements—even those you don't work often. By exposing these rarely explored areas to scrutiny, you shore up any potential weak areas *before* the weakness becomes obvious through mishap experience.

Flying-Hour Milestones

10,000

Maj. Gen. James C. Wahleithner, 4 AF/CC
SMSgt. John A. Kunkle, 142 TAS
SMSgt. Jose R. Guitierrez, 772 TAS

5,000

Col. Thomas L. Neubert, 730 MAS
Lt. Col. Ralph C. Aymin, 193 SOG
Lt. Col. David M. Cordera, 8 MAS
Lt. Col. Edward I. Cross, 3 MAS
Lt. Col. Ronald G. Harrington, 139 TAS
Lt. Col. Thomas G. Smithhart, 172 MAG
Maj. Kirk D. Bentson, 97 MAS
Maj. Edward M. Blaess, Det 4, 1401 MAS
Maj. George M. Culverhouse, 9 MAS
Maj. Samuel C. Dearing, 709 MAS
Maj. Gregory A. Doten, 22 MAS
Maj. William Drawbaugh, 709 MAS
Maj. Harvey R. Hutcheson, 709 MAS
Maj. John R. Kramer, 11 AAS
Maj. Jay F. Lacklen, 709 MAS
Maj. Charles A. Martell, 21 AF/DOV
Maj. Barry J. McKay, 86 MAS
Maj. Michael A. Niziol, 758 TAS
Maj. Marion G. Pritchard, Jr., 139 TAS
Maj. Henry T. Rogers, 709 MAS
Maj. Robert E. Scotch, 709 MAS
Maj. John E. Sutton, 709 MAS
Maj. Michael D. Vargo, 172 MAG
Maj. Theron D. Ward, 145 TAG
Capt. Robert A. Ferguson, 8 MAS
Capt. Craig R. Monsen, 14 MAS
Capt Douglas W. Strodtbeck, 97 MAS
SMSgt. David C. Getty, 139 TAS
MSgt. Larry D. Davis, 709 MAS
MSgt. Richard A. Diehl, 1 SOS
MSgt. Robert W. Garcia, 301 MAS
MSgt. John D. Killeen, 139 TAS
MSgt. James T. Maddux, 67 ARRS
MSgt. Myron J. Nazar, 911 TAG
MSgt. Barry N. Rumfelt, 145 TAG
MSgt. Arthur Vogt, 3 MAS
TSgt. Jonathan C. Bonnett, 709 MAS
TSgt. Antonio S. King, 86 MAS
TSgt. Gerald G. Manley, 7 SOS
TSgt. Keith Windmeyer, 8 MAS
SSgt. John W. Grohoski, 8 MAS
SSgt. Paul L. Miller, 8 MAS

2,500

MSgt. Daniel L. Hodler, 23 AF/DOV
MSgt. Michael M. Stoyle, 41 ARRS
MSgt. Timothy J. Trepanier, 31 ARRS

Ranks and units are those at time of award.
See MACR 900-3 for details on how to apply for your own milestone award.

QUICKSTOPPERS

WHICH WAY DID IT GO?

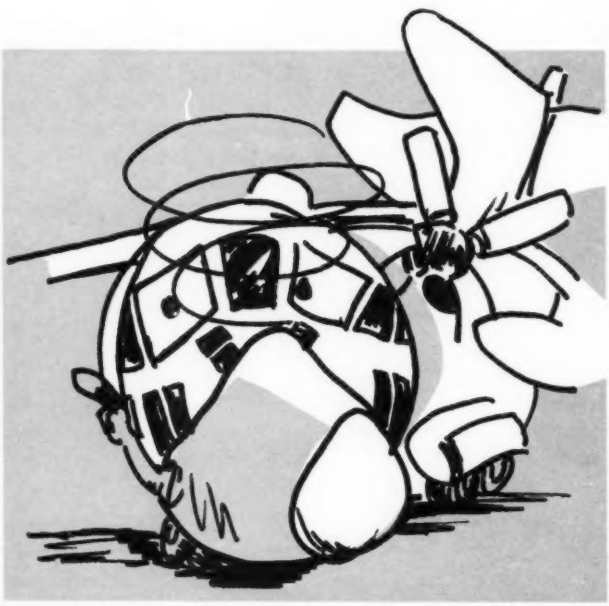
The crew of this airlifter noticed a vibration in the nosewheel during takeoff roll. The vibration was similar to that encountered on a rough runway so the crew considered it as such—that is, until gear retraction. Cockpit indications showed the main gear was up and locked, but the nose gear indicated in-transit.

Unfazed by this twist of fate, the pilot extended the landing gear and received down and locked indications on all of them. There was, however, one problem—the right nosewheel was cocked to the right about 45 degrees and wobbling. Additionally, the right nosewheel door was dented and bent. At this point, the astute AC declared an emergency and jettisoned mega-fuel in preparation for landing.

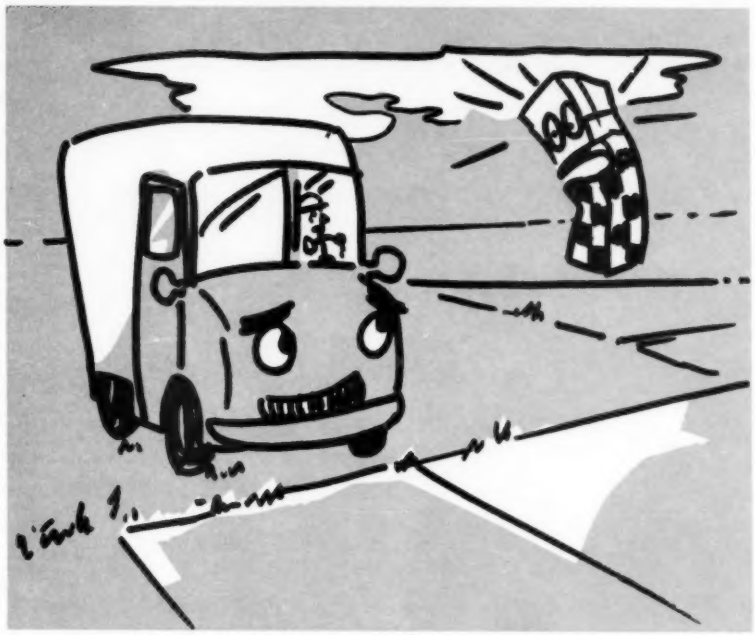
Three thousand feet of runway were foamed and the crew executed an approach and lowered the nosewheel to touch down in the foam. As the aircraft decelerated to about 60 knots, it exited the foam. Almost immediately the right nosewheel separated from the aircraft and rolled off the left side of the runway. The aircraft rolled to a stop and an uneventful aircraft evacuation ensued. Examination revealed the right nosewheel bearing failed due to excessive heat caused by improper lubrication during installation.

HEMOTYMPANUM

This C-130 was climbing to FL 250 in preparation for a high altitude, high opening (HAHO) airdrop of eight paratroopers. Equipment and personnel checks were accomplished at 5,000 ft intervals, the last accomplished at 20,000 ft. Leveling at FL 250 and about four minutes from drop, the paratroopers stood up to prepare for the jump. At this time, one of them inadvertently disconnected from the paratrooper oxygen console. About three minutes later, he lost consciousness and slumped to the floor. The two aerospace physiological observers (ASPOs) on board immediately administered oxygen to the unconscious paratrooper and the pilot initiated an emergency descent. The paratrooper regained consciousness as the aircraft descended through 16,800 ft. The pilot returned the aircraft to its departure airfield shortly thereafter. Upon landing, a second paratrooper complained of an ear block incurred during the rapid descent. Both individuals were transported to the hospital, treated, and subsequently released. The flight surgeon determined hypoxia the cause of the first paratrooper's loss of consciousness. The second individual's symptoms were diagnosed as hemotympanum of the right ear (blood behind the ear).



DO NOT ENTER . . .



The eagle-eyed personnel of a Pacific control tower observed a USAF-blue van enter the departure end of the south runway (without authorization) as an aircraft was on a short final. Needless to say, tower directed the aircraft go around. Investigation revealed the van driver wasn't flightline qualified. It seems our errant driver was taking a short cut from north to south side on the east perimeter road where he made a wrong turn into the center ramp, and then a left turn on the south runway. Since road markings, restricted area signs, and entry control point signs were all in place and highly visible, issuing a relief map of the flightline area may be the next step in insuring adequate flightline driver training. From the aviator's point of view, this incident points out the need to *always* be alert for the unexpected.

HOLD ME TIGHT . . .

We imagine the first jump after initial paratroop training is exciting under any circumstances—but not quite as exciting as in this particular case. This CH-3 helicopter was approaching the drop zone for static line paratroop deployment. The safetyman check and predeployment checklist completed, our student PJ eagerly prepared himself for deployment. Of course, we all know the correct technique for exit is to center oneself in the doorway and step directly forward. Not so this jumper, who positioned himself off-center towards the rear of the aircraft and exited by stepping slightly forward. The unfortunate student caught the saddle portion of his right leg strap on the cargo door latch where he remained suspended upright for about 5 to 10 seconds until the jumpmaster and instructor PJ grasped him by the harness and pulled him back in the helicopter. Here is one fellow who can literally say he can walk on thin air. Oh, what a difference a few feet make.

QUICKSTOPPERS

DISAPPEARING RAFT

While descending through 9,000 ft MSL at 210 KIAS, this C-130 crew heard a rumble, a bang, and felt a slight shudder in the aircraft. After the pilot lowered the flaps and performed an uneventful controllability check, the loadmaster noticed the left wing raft compartment was empty. The aircraft landed uneventfully, but further investigation revealed some damage to the left horizontal stabilizer. The next day, after temporary repairs to the stabilizer leading edge, the aircrew returned to home base. Neither the life raft nor its contents were ever recovered. Initial inspection revealed the raft compartment door had been forced open by an inflated raft, although it appeared compartment door latches were safetied and in place; pressure marks were also noticeable on the inside of the door ribs. The raft kit had been inspected about four months earlier. The inflation bottle was properly vented and inspected. Research indicates a dozen similar mishaps reported in the last five years. Nearly all resulted in structural damage to the horizontal stabilizer or elevator. Although the exact cause of this inadvertent occurrence wasn't determined, probable cause is internal failure of the raft valve. Now you see it . . . now you don't . . . .

AFTER DEADLINES

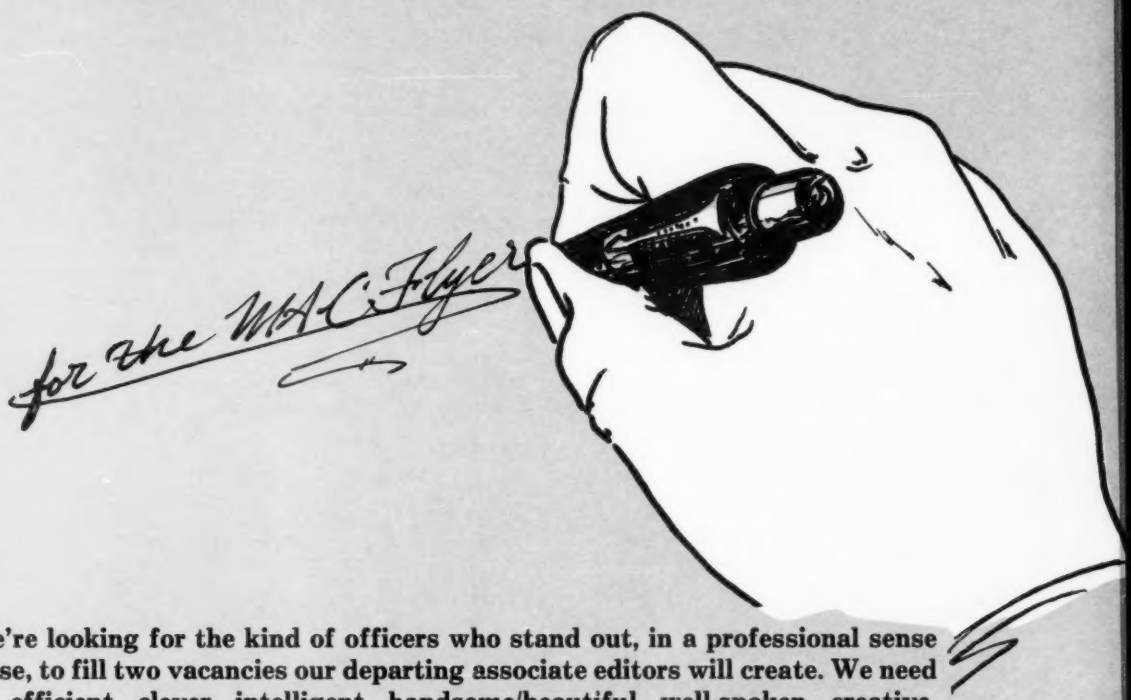
A FOUR-MONTH MISHAP-FREE PERIOD—ended on 19 June 1987 when the crash of a MAC-gained ANG HH-3 helicopter in the Sonora Pass, California, resulted in minor injuries to one crewmember and a seriously damaged aircraft. This incident was followed by the crash of a C-130E at Fort Bragg, North Carolina, 1 July 1987, during a LAPES demonstration. Four of six crewmembers were killed. These two extremely unfortunate mishaps in the MAC community reinforce, once more, that safety consciousness is and should always be at work in everything we do.

FAA ANNOUNCES A CHANGE—in radar separation limits during final approach. The new limits have been in effect since 9 April 1987 and affect separation between aircraft on final approach inside the final approach fix. The change is from the minimum three mile separation FAA has enforced for over 40 years. It does not apply to wet runway conditions as yet. FAA plans to collect and analyze wet runway data before implementing this procedure in wet runway environments. In addition, the new limit may be used only when operationally needed and approved by FAA Headquarters; leading aircraft weight class is the same or less than trailing aircraft; a runway occupancy time of less than 50 seconds is documented; Brite/TCDD displays are operational and used for quick glance reference; turnoff points are visible from the tower; and the runways are clear and dry. Heavy aircraft and Boeing 757s are excluded from this separation reduction.

AUSTRALIANS MARK NEW MILESTONE—with their C-130 fleet. Hailed as one of the world's greatest aviation safety records, the Royal Australian Air Force reached a 400,000 accident-free flying hour milestone. The record has taken 28 years to amass, further testimony to the dedication necessary to reach this milestone. Australia was the first nation outside the U.S. to put C-130s to work in their Air Force. Australia took delivery of its first 12 C-130As beginning in November 1958. The RAAF now has a fleet of 24 C-130s, comprised of "E" and "H" models. They've phased out their "As." Congratulations from the staff of *TMF*!

☆ US GOVERNMENT PRINTING OFFICE: 1987 754-015/40011

We're looking for a few good pens.



We're looking for the kind of officers who stand out, in a professional sense of course, to fill two vacancies our departing associate editors will create. We need proud, efficient, clever, intelligent, handsome/beautiful, well-spoken, creative, thorough, informed, and enthusiastic individuals who possess superb writing skills. That's right, we're lowering our standards. We know we can't *really* replace the editors we now have. Sometimes though, you just have to move on, and so it is with our current modest authors (who'd undoubtedly be Pulitzer winners except for GPO restrictions), both of whom edited this ad. We'll have positions available in May and July of 1987 for two rated captains and/or junior majors. Flight safety experience is a plus; a sense of humor is required; modesty is optional. Before concluding you haven't a chance of qualifying, remember: a journalism or public affairs background *isn't* a requirement (though it certainly won't disqualify you). Check through a few issues of *TMF* and you'll see we write just the way we talk (and we're working on improving the way we talk). This could be your big break! If you're even remotely interested (not to imply the kind of tour this is), give Major Weinzierl, Supervising Editor, a call at AV 576-3534/5542.